

Amendments to the Claims:

Rewrite the claims as set forth below. This listing of claims replaces all prior versions and listings of claims in the application:

1. (Currently amended) A method for hierarchical Z buffering and stenciling comprising:

comparing a tile Z value range of a tile with a hierarchical Z value range and a stencil code;

updating the hierarchical Z value range and the stencil code in response thereto; and

determining whether to render a plurality of pixels within the tile based on the comparison of the tile Z value range with the hierarchical Z value range and the stencil code.

2. (Original) The method of claim 1 wherein the step of determining whether to render a plurality of pixels further comprises:

determining at least one of the following: (1) if a stencil test fails, (2) if the stencil test passes and a hierarchical Z value test fails and (3) if the stencil test passes and the hierarchical Z value test passes on at least one pixel in the tile.

3. (Original) The method of claim 2 further comprising:

rendering the pixels of the tile when the stencil test passes and the hierarchical Z value test passes on at least one pixel in the tile.

4. (Original) The method of claim 2 further comprising:

killing the tile when at least one of the following occurs: the stencil test fails or the stencil test passes and the hierarchical Z value test fails.

5. (Original) The method of claim 1 wherein the tile Z value range contains a tile MinZ and a tile MaxZ and the hierarchical Z value range contains a hierarchical cache MinZ and a hierarchical cache MaxZ.

6. (Original) The method of claim 5 wherein the stencil code is a three bit data value representing a range of stencil values in the tile relative to a background value.

7. (Original) The method of claim 1 wherein the step of determining whether to render a plurality of pixels further comprises:

determining if a per-pixel depth operation needs to be performed; and

determining if stencil operations need to be performed.

8. (Currently amended) A method for hierarchical Z buffering and stenciling comprising:

[[a)] receiving a tile having a plurality of pixels;

[[b)] determining if the tile is visible relative to a stencil; [[and]]

[[c)] determining if the tile is visible in a hierarchical Z ~~plane~~; plane; and
updating a hierarchical Z value range and a stencil code in response thereto.

9. (Currently Amended) The method of claim 8 further comprising:

[[d)] generating an indicator to indicate whether to render the plurality of pixels within the tile.

10. (Original) The method of claim 9 wherein the decision whether to render the plurality of pixels within the tile includes:

determining if a per-pixel depth operation needs to be performed; and

determining if stencil operations need to be performed.

11. (Currently amended) The method of claim 8 wherein ~~step (b) further~~ determining if the tile is visible in a hierarchical Z plane comprises:

[[(b1)]] generating a stencil code; and

[[(b2)]] comparing the stencil code to a stencil value and a stencil mask.

12. (Original) The method of claim 11 wherein the stencil code is a multiple-bit indicator which specifies the relation of a plurality of stencil values in the tile relative to a background value.

13. (Currently amended) The method of claim 11 wherein ~~step (e) further~~ determining if the tile is visible in a hierarchical Z plane comprises:

[[(c1)]] receiving a MinZ and a MaxZ for the tile;

[[(c2)]] comparing the MinZ and the MaxZ to a hierarchical Z range; and

[[(c3)]] wherein at least one of the plurality of pixels is visible in the z-plane, indicating the tile is visible in the hierarchical Z plane.

14. (Original) The method of claim 12 further comprising:
generating an indicator, wherein the indicator indicates at least one of the following: a positive indication when it is determined that the tile is visible relative to the stencil and it is determined that the tile is visible in the hierarchical Z plane and a negative indication when it is determined that the tile is not visible relative to the stencil or it is determined that the tile is not visible in the hierarchical Z plane.

15. (Original) The method of claim 14 wherein the pixels of the tile are rendered if the indicator indicates a positive indication and wherein the tile is killed if the indicator indicates a negative indication.

16. (Cancelled)

17. (Currently amended) An apparatus for hierarchical Z buffering and stenciling comprising:

a comparator;

a hierarchical Z buffer and stencil cache operably coupled to the comparator; and

a hierarchical Z buffer and stencil cache updater operably coupled to the comparator wherein the hierarchical Z buffer and stencil cache provides a cache MinZ, a cache MaxZ, and a stencil code to the comparator.

18. (Currently amended) The apparatus of claim 17 further comprising:

~~a tile comprising a plurality of pixels wherein the tile has a tile MinZ and a tile MaxZ wherein the comparator is operative to receive a tile MinZ and a tile MaxZ associated with a tile having a plurality of pixels.~~

19. (Currently Amended) The apparatus of claim [[18]] 17 wherein the comparator receives the tile MinZ and the tile MaxZ and compares ~~the a tile MinZ and the a tile MaxZ~~ to the cache MinZ, the cache MaxZ, and compares the stencil code to a stencil value and a stencil mask to determine if a per-pixel depth operation needs to be performed and to determining determine if stencil operations need to be performed.[[.]]

20. (Original) The apparatus of claim 19 wherein the comparator generates an indicator that indicates the visibility of the plurality of pixels of the tile relative a stencil mask and a hierarchical Z plane.

21. (Original) The apparatus of claim 20 further comprising:
a kill module operably coupled to the hierarchical Z buffer and stencil cache updater wherein the hierarchical Z buffer and stencil cache updater receives the indicator from the comparator and the hierarchical Z buffer and stencil cache updater provides a kill signal to the kill module based on the indicator.

22. (Original) The apparatus of claim 21 wherein the hierarchical Z buffer and stencil cache updater updates the hierarchical Z buffer and stencil cache in response to the indicator.

[[22]] 23. (Currently Amended) A graphics processing engine comprising:
~~a tile comprising a plurality of pixels wherein the tile has a tile MinZ and a tile MaxZ;~~
a comparator operative to receive a tile MinZ and a tile MaxZ associated with a tile having a plurality of pixels;
a hierarchical Z buffer and stencil cache operably coupled to the ~~comparator; and~~
comparator; and
a hierarchical Z buffer and stencil cache updater operably coupled to the comparator wherein the hierarchical Z buffer and stencil cache provides a cache MinZ, cache MaxZ, and a stencil code to the comparator, wherein the comparator ~~receives the tile MinZ and the tile MaxZ and~~ compares the tile MinZ and the tile MaxZ to the cache MinZ, the cache MaxZ, and compares the stencil code to a stencil value and a stencil mask. [[.]]

[[23]] 24. (Currently amended) The apparatus of claim [[22]] 23 wherein the comparator generates an indicator that indicates the visibility of the plurality of pixels of the tile relative to ~~the~~ stencil mask and a hierarchical Z plane.

[[24]] 25. (Currently amended) The apparatus of claim [[23]] 24 further comprising:
a kill module operably coupled to the hierarchical Z buffer and stencil cache updater wherein the hierarchical Z buffer and stencil cache updater receives the indicator from the comparator and the hierarchical Z buffer and stencil cache updater provides a kill signal to the kill module based on the indicator and wherein the hierarchical Z buffer and stencil cache updater updates the hierarchical Z buffer and stencil cache in response to the indicator.

26. (new) The method of claim 1, wherein comparing a tile Z value range with a hierarchical Z value range and a stencil code comprises comparing the stencil code to a stencil value and a stencil mask.

27. (new) A method for hierarchical Z buffering and stenciling comprising:
determining if a tile is visible relative to a stencil by generating a stencil code and comparing the stencil code to a stencil value and a mask; and
determining if the tile is visible in a hierarchical Z plane by comparing a MinZ and a MaxZ for the tile to a hierarchical Z range.

28. (new) The method of claim 27, further comprising:
generating an indicator wherein the indicator indicates a positive indication when the tile is visible relative to the stencil and visible in the hierarchical Z plane, and wherein the indicator indicates a negative indication when the tile is not visible relative to the stencil or in the hierarchical Z plane; and

rendering pixels of the tile if the indicator indicates the positive indication; and
killing the tile if the indicator indicates the negative indication.

29. (new) The method of claim 28, further comprising updating the hierarchical Z value range and the stencil code.